

Method and Apparatus for Continuously and
Quantitatively Supplying Bread Dough ✓

Background of Invention

1. Field of Invention

The present invention relates to a method and apparatus for bread production, more particularly a process and apparatus for stably forming a continuous and uniform belt-like strip of a predetermined thickness from a gel-like elastic material such as bread dough in a hopper by having such dough contained in the hopper effectively and constantly flow downward from an outlet provided at the bottom of the hopper.

2. Prior Art

In a conventional method to produce a large amount of bread, a certain amount of bread dough in a hopper is sucked by a piston into a cylinder provided at the bottom of the hopper, and then a certain amount of the bread dough is cut and extruded, and this cutting and extruding step is repeated. This method contains many complicated steps.

Also, by this method repeated shearing stress applied to the bread dough decreases its elasticity. Therefore, a chemical additive such as potassium bromate has been added to restore the original gluten tissue and to recover its membrane function required for producing bread.

Two relevant prior-art inventions have been disclosed, in Japanese Patent Publication Nos. 5-3253 and 6-37. By these inventions dough is pressed by rotating opposed rollers to continuously produce a dough strip. However, these inventions provide a method by which the pressure on bread dough caused by pairs of opposed rollers aligned one above the other is prevented from rising by detecting with a sensor a relevant amount of dough supplied from an upper pair of pressing rollers to a lower pair of pressing rollers, to thereby adjust the rotating speed of the upper pressing rollers.

Singapore Patent Application No. 9609847-0, filed on May 21, 1996, by this applicant, discloses a method and apparatus for continuously and uniformly supplying dough. By that method and apparatus, at least one horizontally positioned pair of means that are rotatable in opposite directions is provided, the distance between the pair of means being repeatedly increased and decreased to prevent the increase of stress in the dough located between the pair of means, so that the dough can be constantly discharged from the gap between the pair of means.

As shown in Fig. 1 to illustrate the second embodiment of the prior application, the apparatus includ/es the opposed pairs of means, namely the groups 20 and 20' of rolls. They comprise rolls 21, 22, 23, and 24, and rolls 21', 22', 23', and 24', respectively. The groups 20 and 20' are oppositely positioned, namely the rolls 21, 22, 23, and 24 are opposite the rolls 21' 22', 23', and 24', respectively, to compose four pairs of rolls. These rolls are rotated in opposite directions to pull the dough 3 downward, while the swingable rod 10' on which the rolls 21, 22,

23, and 24 are mounted is swung about the supporting point 10, while the arm 11' on which the rolls 21', 22', 23', and 24' are mounted is swung about the supporting point 11, by energizing the motors 12 and 13. Therefore, these pairs of rolls are repeatedly and reciprocally moved. The distances between the pairs of rolls are repeatedly increased and decreased, so that the pressure on the dough 3 located between the roll groups 20 and 20' can be prevented from increasing and the dough 3 flows downward from the gap c.

However, the contact areas of the rotating rolls 21, 22, 23, and 24, and rolls 21', 22', 23', and 24', of the groups 20 and 20' with the surface of the dough 3 are relatively small. Further, the frictional force of a roll on the bread dough is relatively low, as compared with that of the belt of a belt conveyor. Therefore, the effectiveness in pulling the dough downward by the frictional engagement of the rolls with the surface of dough is low, leading to a low effectiveness in producing a large amount of bread dough.

Summary of Invention

Therefore, this invention aims at overcoming the disadvantage in the prior application by enhancing the discharging effectiveness of dough from the gap between opposed pairs of means, while retaining effective pressing movements by the opposed pairs of means.

An object of this invention is to provide a method of continuously and quantitatively supplying bread dough, which

comprises providing a pressing means, which comprises two movable means, one of which is at least one roller or one belt conveyor and the other of which is at least one belt conveyor, and which two movable means are oppositely positioned in a generally horizontal direction, below a bread dough feeder, putting bread dough into said bread dough feeder, and actuating said two movable means to reciprocally move in a generally horizontal direction to increase and decrease the distance between said two movable means, thereby preventing the pressure on said bread dough positioned between said two movable means from being increased so as to allow said bread dough to flow stably downward from therebetween.

Another object of this invention is to provide an apparatus for continuously and quantitatively supplying bread dough comprising a pressing means provided below a bread dough feeder, which pressing means comprises two movable means, one of which is at least one roller or one belt conveyor, and the other of which is at least one belt conveyor, said roller being adapted to rotate about its own axis to apply a force to pull bread dough downwards and said belt conveyor being adapted such that its conveying surface moves from above downwards to apply a force to pull the bread dough downwards, and which two movable means are oppositely positioned in a generally horizontal direction, both or either of said two movable means being adapted to reciprocally move in a generally horizontal direction to increase and decrease the distance between said two movable means, thereby preventing the pressure on said bread dough positioned between said two movable means from being increased so as to allow said bread dough to flow stably

downward from therebetween.

Brief Description of the Drawings

Fig. 1 is a sectional view to illustrate the function of the apparatus of the second embodiment of the prior application.

Fig. 2 is a sectional view to illustrate the function of the apparatus of a first embodiment of this invention.

Fig. 3 is a sectional view to illustrate the function of the apparatus of a second embodiment of this invention.

Fig. 4 is a sectional view to illustrate the function of the apparatus of a third embodiment of this invention.

Explanation of the Preferred Embodiments

A first embodiment of this invention will be explained below by reference to Fig. 2.

Just below the bottom opening of a bread dough feeder, namely, a hopper 40, the pressing means of this invention is disposed. It comprises two movable means. One of the two movable means comprises two belt conveyors 55 and 56. The belt conveyor 55 comprises rollers 21 and 22, and an endless belt entrained over the rollers 21 and 22. The shafts of the rollers 21 and 22 are received in bearings (not shown) mounted on a swingable rod 10'. The rollers 21 and 22 are adapted to rotate by respective drive means (not shown) at the same peripheral

speed in directions indicated by arrows in Fig. 2, so that the conveying surface of the endless belt entrained over the rollers 21 and 22 is moved to pull the bread dough 3 downward.

Below the belt conveyor 55, the belt conveyor 56 is serially disposed. The belt conveyor 56 comprises rollers 23 and 24, and an endless belt entrained over the rollers 23 and 24. The shafts of the rollers 23 and 24 are received in bearings (not shown) mounted on the swingable rod 10'. The rollers 23 and 24 are also adapted to rotate by respective drive means (not shown) in directions indicated by arrows shown in Fig. 2 at a peripheral speed higher than that of the rollers 21 and 22. Therefore, the conveying surface of the belt entrained over the rollers 23 and 24 is moved downward to pull the bread dough 3 downward at a conveying speed higher than that of the conveying surface of the belt conveyor 55.

On the swingable rod 10' an arm 14 is mounted. The arm 14 has a pin, about which a crank arm 15 can swing. One end of the crank arm 15 is mounted on a pin mounted on a rotary disk of a motor 12.

Therefore, when the motor 12 is energized, the crank arm 15 swings about the pin of the rotary disk, and simultaneously swings about the pin of the arm 14, so that the arm 14 swings about a supporting point 10. Therefore, the arm 14 and the conveying surfaces of the belt conveyors 55 and 56 are reciprocally moved in a generally horizontal direction while the conveying surfaces of the belt conveyors 55 and 56 pull the bread dough 3 downward.

The other of the two movable means of the pressing means comprises two belt conveyors 55' and 56'. The belt conveyor 55' comprises rollers 21' and 22', and an endless belt entrained over the rollers 21' and 22'. The shafts of the rollers 21' and 22' are received in bearings (not shown) mounted on a swingable rod 11'.

The rollers 21' and 22' are adapted to rotate by respective drive means (not shown) at the same peripheral speed, so that the conveying surface of the endless belt entrained over the rollers 21' and 22' is moved downward to pull the bread dough 3 downward.

Below the belt conveyor 55' the belt conveyor 56' is serially disposed. The shafts of the rollers 23' and 24' are received in bearings (not shown) mounted on the swingable rod 11'. The rollers 23' and 24' are also adapted to rotate by respective drive means (not shown) in directions indicated by arrows in Fig. 2, at a peripheral speed higher than that of the rollers 21' and 22'. Therefore, the conveying surface of a belt entrained over the rollers 23' and 24' is moved to pull the bread dough 3 downward at a conveying speed higher than that of the belt conveyor 55'.

The conveying speed of the belt conveyor 55 can be controlled to be the same as that of the belt conveyor 55'. Similarly, the conveying speed of the belt conveyor 56 can be controlled to be the same as that of the belt conveyor 56'.

An arm to be mounted on the swingable rod 11' and a part of a

crank arm to be swingably mounted on the arm are not shown in Fig. 2. However, the structure of the means to swing the belt conveyors 55' and 56' is the same as for the belt conveyors 55 and 56, so that when a motor 13 is energized, the swingable rod 11' can swing about a supporting point 11. Therefore, the conveying surfaces of the belt conveyors 55' and 56' are reciprocally moved in a generally horizontal direction while the conveying surfaces of the belt conveyors 55' and 56' pull the bread dough 3 adjacent them downward.

As shown in Fig. 2, the pressing means of this invention forms a V-shape. The lowermost part of the pressing means provides a gap c. Below the pressing means a belt conveyor 26 is disposed to receive and convey bread dough 3 flowing downward from the gap c. The distance between the conveying surface of the belt conveyor 55 and the conveying surface of the belt conveyor 55' is greater than the distance between the conveying surface of the belt conveyor 56 and the conveying surface of the belt conveyor 56'. Namely, the distance between the opposed conveying surfaces of an upper pair of belt conveyors is greater than that between the opposed conveying surfaces of a lower pair of belt conveyors.

Therefore, when three or more pairs of belt conveyors are tiered, the distance between opposed conveying surfaces of a lower pair is less than that between opposed conveying surfaces of an upper pair.

The range and speed of the swing can be controlled by synchronously controlling the speeds of the motors 12 and 13.

When the pressing means is actuated by energizing the motors 12 and 13, the swingable rods 10' and 11' swing about the supporting points 10 and 11, respectively. Therefore, the conveying surfaces of the belt conveyors 55 and 56 move downward, and simultaneously move reciprocally in a generally horizontal direction, to approach, and retract from, the conveying surfaces of the belt conveyors 55' and 56', respectively. Further, the swinging movements of the swingable rods 10' and 11' are controlled to be synchronized so that the conveying surfaces of the belt conveyors 55 and 56 and the opposed conveying surfaces of the belt conveyors 55' and 56' can be moved so as to simultaneously approach each other and to simultaneously retract from each other, thereby repeatedly pressing, and releasing the pressure from, the bread dough 3 positioned between them.

Thus, the bread dough 3 located in the pressing means sustains the repeated pressing and releasing action of the pressing means. Therefore, the pressure upon the bread dough 3 is prevented from increasing, so that it is softened in the pressing means, to thereby flow downward from the gap c.

The discharge speed of bread dough from the pressing means generally equals the peripheral speeds of the lowermost belt conveyors.

Either of the two movable means of the pressing means of this invention can be reciprocally moved in a generally horizontal direction by means of the swingable rods 10' or 11', which both

swing about the supporting points 10 or 11, respectively. However, these belt conveyors may be reciprocally moved by means of any relevant devices so that these belt conveyors can be linearly moved in a horizontal direction.

Either of the two movable means of the pressing means of this invention can be reciprocally moved to increase and decrease the distance between the two movable means. For instance, only the belt conveyor 55 or 56 may be reciprocally moved, while its conveying surface is moved downward, and the belt conveyors 55' and 56' are not reciprocally moved, while their conveying surfaces are moved downward.

Alternatively, swingable rods, arms, crank arms, and motors, can be provided for the respective belt conveyors 55, 56, 55', and 56', respectively, so that these belt conveyors can be actuated for their respective conveying and reciprocating movements.

Therefore, the reciprocal movements of the pair of upper belt conveyors 55 and 55' can be carried out alternately with the reciprocal movements of the pair of lower belt conveyors 56 and 56'. Namely, for example, for one or two seconds the reciprocal movements of the belt conveyors 55 and 55' are stopped, and the reciprocal movements of the belt conveyors 56 and 56' are carried out. Then for one or two seconds the reciprocal movements of the belt conveyors 55 and 55' are carried out, and the reciprocal movements of the belt conveyors 56 and 56' are stopped. These movements are repeatedly carried out, so that the bread dough 3 can be pressed and not pressed. Further, when three or more pairs of belt conveyors are tiered, the

reciprocal movements of a pair of upper belt conveyors can be transmitted to the reciprocal movements of a pair of lower belt conveyors.

In any event, the bread dough 3 from the hopper 40 easily enters the gap between the two movable means. Therefore, in the prior method a problem wherein bread dough positioned between opposed rollers or bread dough remaining in the hopper does not fall due to a bridge phenomenon is resolved, so that bread dough is readily fed downward. Further, the conveying surface of a belt conveyor is relatively wide and its frictional force against bread dough is usually higher than that of the surface of a roller. Therefore, the bread dough 3 is more effectively pulled downward by the conveying surfaces of the belt conveyors 55, 56, 55', and 56', as compared with the invention of the prior application.

As explained above, in this embodiment the two movable means are arranged to form a V-shape. However, the shape formed by the two movable means is not limited to a V-shape. Also, the rate of reduction of the distance between opposed belt conveyors, the angle of the V-shape, and the conveying speeds of respective belt conveyors, can be optionally selected.

In this embodiment the supporting points are positioned at the upper ends of the swingable rods. However, if a quantitative supply of bread dough is effected, the position of a supporting point can be optionally selected. Therefore, the position of a supporting point is not limited to the positions of this embodiment.

In this embodiment the two belt conveyors 55 and 56 are used for one of the two movable means. However, alternatively, a single belt conveyor may be used. In this case a single belt conveyor may be disposed for the other movable means. Namely, a pair of belt conveyors are disposed below the hopper 40. Swingable rods, arms, crank arms, and motors are provided for the respective belt conveyors. When the motors are energized, the two conveying surfaces of the belt conveyors press, or lessen the pressure on, the bread dough 3 and pull the softened bread dough 3 downward.

A second embodiment of this invention will be explained below by reference to Fig. 3.

This embodiment is almost the same as that of the first embodiment except that one of the movable means is composed of one belt conveyor, namely, the belt conveyor 56'. An arm to be swingably mounted on a swingable rod 17 and a part of a crank arm to be mounted on the arm are not shown in Fig. 3. The conveying and reciprocating movements of the belt conveyor 56' are similar to those of the first embodiment.

A third embodiment of this invention will be explained below by reference to Fig. 4.

Just below the bottom opening of a hopper 40, the pressing means of the third embodiment is disposed. It comprises two movable means. One of the two movable means comprises two belt conveyors 55 and 56. These and related means and their

functions are the same as those of the pressing means of the first embodiment.

The other of the two movable means of the pressing means comprises a roller group 20' comprising rollers 21', 22', 23', and 24' .

The shafts of these rollers are received in respective bearings (not shown) mounted on a swingable rod 11', and these rollers can be rotated about their axes by means of respective drive means (not shown).

The peripheral speeds of the rollers 21' and 22' are adapted to be the same as the conveying speeds of the belt conveyor 55, and the peripheral speeds of the rollers 23' and 24' are adapted to be the same as the conveying speed of the belt conveyor 56. Further, the peripheral speeds of the rollers 23' and 24' are higher than those of the rollers 21' and 22' . *

Alternatively, the peripheral speed of a lower roller can be adapted to be higher than that of an upper roller, since these rollers 21', 22', 23', and 24' are adapted to be separately energized by means of respective drive means. Each of these drive means is controlled by a control unit (not shown) so that the peripheral speed of a lower roller is higher than that of an upper roller. Namely, the peripheral speed of the roller 24' is higher than that of the roller 22'. Similarly, the peripheral speed of the roller 23' is higher than that of the roller 22'. In this case, the conveying speed of the belt conveyor 56 needs to be about the same as the peripheral speed of the roller 24', and

to be faster than the conveying speed of the belt conveyor 55. Further, the conveying speed of the belt conveyor 55 needs to be about the same as the peripheral speed of the roller 22'.

Alternatively, a belt conveyor (not shown) can be disposed between the rollers 21' and 24' in place of the rollers 22' and 23'.

An arm to be mounted on the swingable rod 11' and a part of a crank arm to be swingably mounted on the arm are not shown in Fig. 4. However, when the motor 13 is energized, the swingable rod 11' can swing about a supporting point 11. Therefore, these rollers are reciprocally moved in a generally horizontal direction while they pull the bread dough 3 downward.

As shown in Fig. 4, the lowermost part of the pressing means provides a gap c. Below the pressing means a belt conveyor 26 is disposed to receive and convey bread dough 3 flowing downward from the gap c.

When the pressing means is actuated by energizing the motors 12 and 13, the swingable rods 10' and 11' swing about the supporting points 10 and 11 respectively. Therefore, the conveying surfaces of the belt conveyors 55 and 56 are moved downward, and simultaneously they reciprocally move in a generally horizontal direction to approach, and retract from, the rollers 21', 22', 23', and 24'. Further, the swinging movements of the swingable rods 10' and 11' are controlled to be synchronized so that the conveying surfaces of the belt conveyors 55 and 56 and the opposed rollers 21', 22', 23', and 24'

can be moved so as to simultaneously approach each other and to simultaneously retract from each other, thereby repeatedly pressing and lessening the pressure on the bread dough 3 positioned therebetween.

Thus, the bread dough 3 located in the pressing means sustains the repeated pressing and releasing action of the pressing means. Therefore, the pressure on the bread dough 3 is prevented from increasing, so that it is softened to thereby flow downward from the gap c.

The discharge speed of the bread dough from the pressing means generally equals the peripheral speeds of the lowermost belt conveyor and the lowest roller.

The reciprocal movements of the rollers 21' and 22' can be adapted to be carried out alternately with the reciprocal movements of the rollers 23' and 24' and in synchronization with the alternate movements of the belt conveyors 55 and 56. Further, the reciprocal movement of an upper roller can be relayed to the reciprocal movements of a lower roller in synchronization with the relay of the reciprocal movements of the belt conveyor 55 to the belt conveyor 56.

In any event, the bread dough 3 from the hopper 40 easily enters the space between the two movable means.

Therefore, a problem in the prior method wherein bread dough positioned between opposed rollers or bread dough remaining in the hopper does not fall due to a bridge phenomenon is

resolved, so that bread dough is readily fed downward.

In this embodiment one of the two movable means comprises four rollers. The frictional force of the surfaces of the rollers is relatively less as compared with the surfaces of the conveyor belts. Therefore, in this embodiment the force to pull bread dough downward is somewhat less than the force in the first embodiment.

However, the bread dough 3 is more effectively pulled downward by the conveying surfaces of the belt conveyors 55 and 56 and the surfaces of the rollers 21', 22', 23', and 24', as compared with the invention of the prior application.

The present invention provides the pressing means comprising two movable means below a bread dough feeder so as to repeatedly increase and decrease the distance between the two movable means when the bread dough from the bread dough feeder is pressed. Therefore, the pressure on the bread dough located between the two movable means is prevented from rising.

Thus, the bread dough can be steadily discharged in a stable condition from the gap between the two movable means. Since at least one of the two movable means of the pressing means of this invention comprises a belt conveyor or a plurality of lengthwise tiered belt conveyors, its conveying surface or their conveying surfaces effectively pull the bread dough downward, as compared with the method and apparatus of the invention disclosed in the prior application of this applicant.

Claims

1. A method of continuously and quantitatively supplying bread dough, comprising providing a pressing means, which comprises two movable means, one of which is at least one roller or one belt conveyor and the other of which is at least one belt conveyor, and which two movable means are oppositely positioned in a horizontal direction, below a bread dough feeder, putting bread dough into said bread dough feeder, actuating said two movable means to reciprocally move in a generally horizontal direction to increase and decrease the distance between said two movable means, thereby preventing the pressure on said bread dough positioned between said two movable means from being increased, so as to allow said bread dough to stably flow downward from therebetween.
2. An apparatus for continuously and quantitatively supplying bread dough comprising a pressing means provided below a bread dough feeder, which pressing means comprises two movable means, one of which is at least one roller or one belt conveyor and the other of which is at least one belt conveyor, said roller being adapted to rotate about its own axis to apply a force to pull bread dough downwards and said belt conveyor being adapted such that its conveying surface moves from above downward to apply a force to pull the bread dough downward, and which two movable means are oppositely positioned in a generally horizontal direction,



both or either of said two movable means being adapted to reciprocally move in a generally horizontal direction to increase and decrease the distance between said two movable means, thereby preventing the pressure on said bread dough positioned between said two movable means from being increased so as to allow said bread dough to flow stably downward from therebetween.

3. The apparatus for continuously and quantitatively supplying bread dough of claim 2, wherein one of said two movable means comprises a plurality of tiered rollers or a plurality of lengthwise tiered belt conveyors and the other comprises a plurality of lengthwise tiered belt conveyors.
4. The apparatus for continuously and quantitatively supplying bread dough of claim 2 or 3, wherein the peripheral speed of each said roller or each of said tiered rollers of said one of said two movable means is about the same as the conveying speed of each said belt conveyor or each of said tiered belt conveyors of the other of said two movable means.
5. The apparatus for continuously and quantitatively supplying bread dough of claim 3 or 4, wherein the peripheral speed of a lower roller of said tiered rollers is higher than that of an upper roller thereof and the conveying speed of a lower belt conveyor of said tiered belt conveyors is higher than that of an upper belt conveyor thereof.



6. The apparatus for continuously and quantitatively supplying bread dough of claim 3, 4, or 5, wherein the reciprocal movements of an upper roller or an upper belt conveyor and an opposed upper belt conveyor to increase and decrease the distance therebetween are carried out alternately with the reciprocal movements of a lower roller or a lower belt conveyor and an opposed lower belt conveyor to increase and decrease the distance therebetween.
7. The apparatus for continuously and quantitatively supplying bread dough of claim 3, 4, or 5, wherein the reciprocal movements of an upper roller or an upper belt conveyor and an opposed upper belt conveyor are in turn relayed to the reciprocal movements of a lower roller or a lower belt conveyor and an opposed lower belt conveyor.
8. The apparatus for continuously and quantitatively supplying bread dough of claim 2, 3, 4, 5, 6, or 7, wherein the distance between said two movable means is such that the distance at the lowermost position is less than that at the uppermost position.
9. The apparatus for continuously and quantitatively supplying bread dough of claim 2, 3, 4, 5, 6, 7, or 8, wherein the reciprocal movements of said roller or rollers and said belt conveyor or belt conveyors are carried out by causing swingable rods on which said roller or rollers or said belt conveyor or belt conveyors are rotatably or movably mounted to swing about respective supporting points provided on the respective locations of the apparatus.

